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STRAIGHT - LINE TRAVEL AID FOR THE BLIND

J. C. SWAIL

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ABSTRACT

A simple orientation aid is described which may be used by a blind person as a straight-line travel aid. This device is based on the directional properties of the ferrite antenna in some small portable transistor broadcast receivers. A simple tone-generating circuit, whose frequency is dependent on the strength of the received signal, has been designed to be added to one of these commercially available receivers. The directional null, therefore, corresponds to minimum pitch. Conclusions as to the instrument's usefulness are drawn, based on actual field tests.

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- I. Straight-line Travel Aid for the Blind

STRAIGHT-LINE TRAVEL AID FOR THE BLIND

- J.C. Swail -

INTRODUCTION

Since the Second World War a number of attempts have been made to develop an electronic travel aid for the blind. For the most part these have employed reflected supersonic or optical energy to indicate the presence of obstacles in the path of the user. If successful, these devices would provide the user with information as to his immediate surroundings. However, none of them would be capable of giving him information as to his direction of travel. These may be likened to a ship's radar, which does not, however, obviate the need for a compass.

A blind person may find it very difficult, under some circumstances, to maintain a straight line while crossing a wide open area. For example, difficulty may be encountered at the wide entrance to a parking lot or service station, a wide street or intersection, or a field, or in maintaining a proper course along the center of a wide sidewalk. Also, it can be very useful to be able to identify by direction which of several streets one is taking at an intersection in which a number of streets converge at odd angles. Confusion under these circumstances is particularly likely to occur under conditions of severe noise or snow.

Recently it came to the author's attention that a number of blind people have been experimenting with the use of small portable transistor broadcast receivers as straight-line travel aids. It is possible to use these receivers because of the extreme directivity of the ferrite-rod antennas in some of these sets.

PRELIMINARY TESTS

One set was given extensive trials for this purpose. However, it soon became apparent that, as it stands, this type of receiver, although giving some information, leaves much to be desired. This is because the automatic gain control action in these receivers masks the null point, except under ideal conditions. To perform satisfactorily, there must be low ambient acoustic and electrical noise, a rather critical value of received signal level from the broadcast station, and appreciable time in which to perform the operation. Also, the varying modulation content can be very confusing to the would-be user, and particularly, pauses in the transmitted speech or music may give a false impression of a directional null. Another problem arises when, as may happen, the user becomes momentarily interested in the program, thus distracting his attention. This could be very dangerous under traffic conditions.

On the whole, one may say that, under some rural conditions, a transistor re-

ceiver can be of some use as a travel aid, but in urban situations an unmodified set may actually be dangerous.

At the outset it was decided that, if an orientation device of this nature was to be acceptable, it should be capable of giving the required information as reliably as possible, and should be light in weight, inconspicuous, inexpensive, and small enough to fit conveniently in the owner's pocket or purse when not required. Therefore, it was decided to try to modify a standard low-cost transistor receiver, which would have the added advantage of providing the blind user with a radio when it was not being used for its new function.

From work done in the past on the design of test equipment for the blind, it is obvious that under conditions of noise it is much simpler to detect a change in pitch of an audible tone rather than a change in amplitude. Also, because of the varying nature of the modulation transmitted by a broadcast station, the carrier would have to be used as the reference.

CIRCUIT DESIGN

For these reasons two alternative circuits (Figs. 1 and 2) were devised which, when connected to the receiver, produce a series of sharp pulses in the set's output. In the absence of a received carrier these pulses are at a very low repetition rate, but as the strength of the received carrier increases the pulse repetition rate increases, producing a high-pitched squeal in the presence of a strong signal. Therefore, if a strong signal is tuned in and the pulse generator put into operation the set may then be rotated for minimum pitch. This will correspond to the null previously mentioned, but it is much easier to distinguish. With a reasonably strong signal, and using a receiver whose design permits of a good null, a discrimination of about five degrees, or better, is possible with this system.

It is very important that care be taken in the selection of a receiver to be used for this purpose. Because of the various designs of ferrite antennas encountered in different makes and the differing circuit board layouts, some receivers work much more satisfactorily than others, giving much sharper nulls.

In the first sets modified in our laboratory the extra circuitry was housed in an enlarged earphone pouch attached to the carrying strap (Plate I). A switch protruded from one end of this pouch and it was connected by a flexible cable to the receiver. However, in later models a smaller battery was substituted in the receiver, and the extra electronics installed, along with the battery, in its storage space. Although this gives shorter battery life, it produces a much more compact and rugged set. The first sets proved too fragile in field use as the

cables were often accidentally pulled from their moorings .

FIELD TRIALS

In order to check the usefulness of the device a number were distributed to blind people in Ottawa and Montreal . The results of these field tests are most encouraging . Although the travel aid does not enable a blind traveler to go anywhere, or do anything he would not do without the device, it does increase his confidence and speed . This is particularly true under snow conditions .

Two difficulties arose, both of which, fortunately, have simple solutions . First, the sound from the loudspeaker made some of the users feel conspicuous while walking along quiet streets, whereas it was completely inaudible under very noisy conditions . Secondly, operation of the device requires one hand, and when a white cane is also being carried, there is no way of handling parcels .

The first problem is simply overcome through the use of the earphone supplied with such receivers . If the phone is equipped with a suitable clip, it may be attached to the shirt collar, which is close enough to the ear to be audible under any conditions so far encountered, and yet not sufficiently loud to attract attention . The earphone can not be worn in the normal way as this would block the user's ear . As a blind person obtains most of his information concerning his surroundings by sound, this would be quite unacceptable .

The second problem was solved through the use of a simple clip, which permitted the set to be attached to a belt or brief case, and yet left it free to be rotated to the desired direction . This also solved another problem encountered by some: that they had difficulty in keeping their hand in the same position relative to the direction of travel . It was suggested that a set kept in the pocket and equipped with a rotating antenna would solve this . However, on investigation this seems too costly to manufacture .

At the suggestion of one of the users, a tactile output was investigated . However, it was discovered that it would consume far too much power, and that the feeling of touch is not sufficiently sensitive to distinguish any simple form of output . It was believed that if the device became complex, much of its potential would be lost no matter how interesting it might be from a technical point of view .

Under some urban conditions where large steel structures are encountered, the device must be used with caution, as these buildings can distort the received pattern drastically . In one instance, the apparent direction of reception shifted by 90 degrees within a space of 25 feet . This is obviously a severe hazard . It is, therefore, recommended that such devices be used on urban routes after the route has been carefully checked over once . In suburban or rural situations this

is probably not necessary. However, the limitation just mentioned is probably not too serious, as most blind persons will be travelling the same route daily and, as a matter of fact, these distortions can serve the very useful function of landmarks in the center of long blocks.

CONCLUSIONS

In conclusion, it is felt that this device, if properly used, can increase the self-confidence of blind people who travel alone and assist them to travel more quickly. As it is small, it may be conveniently carried on the person and be available when required.

It is interesting to note that a number of sighted people have expressed a desire for this instrument, to be used as a combination radio and direction finder in the woods, while hunting or fishing.

The experience gained in these tests has shown conclusively that the device should not be used without an adequate in-the-field lesson. We found that where the sets have been handed out with only verbal or written instructions, problems arose which did not occur where a personal demonstration had been given.

Although the price is not firmly established, it would appear that the travel aid can be produced for less than \$40 — about twice the price of the unmodified radio. The added electronics in no way hamper the set's normal function.



Plate I — Straight-line travel aid for the blind

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Swail, J.C.

Straight-line travel aid for
the blind.

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Swail, J.C.

AUTHOR

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